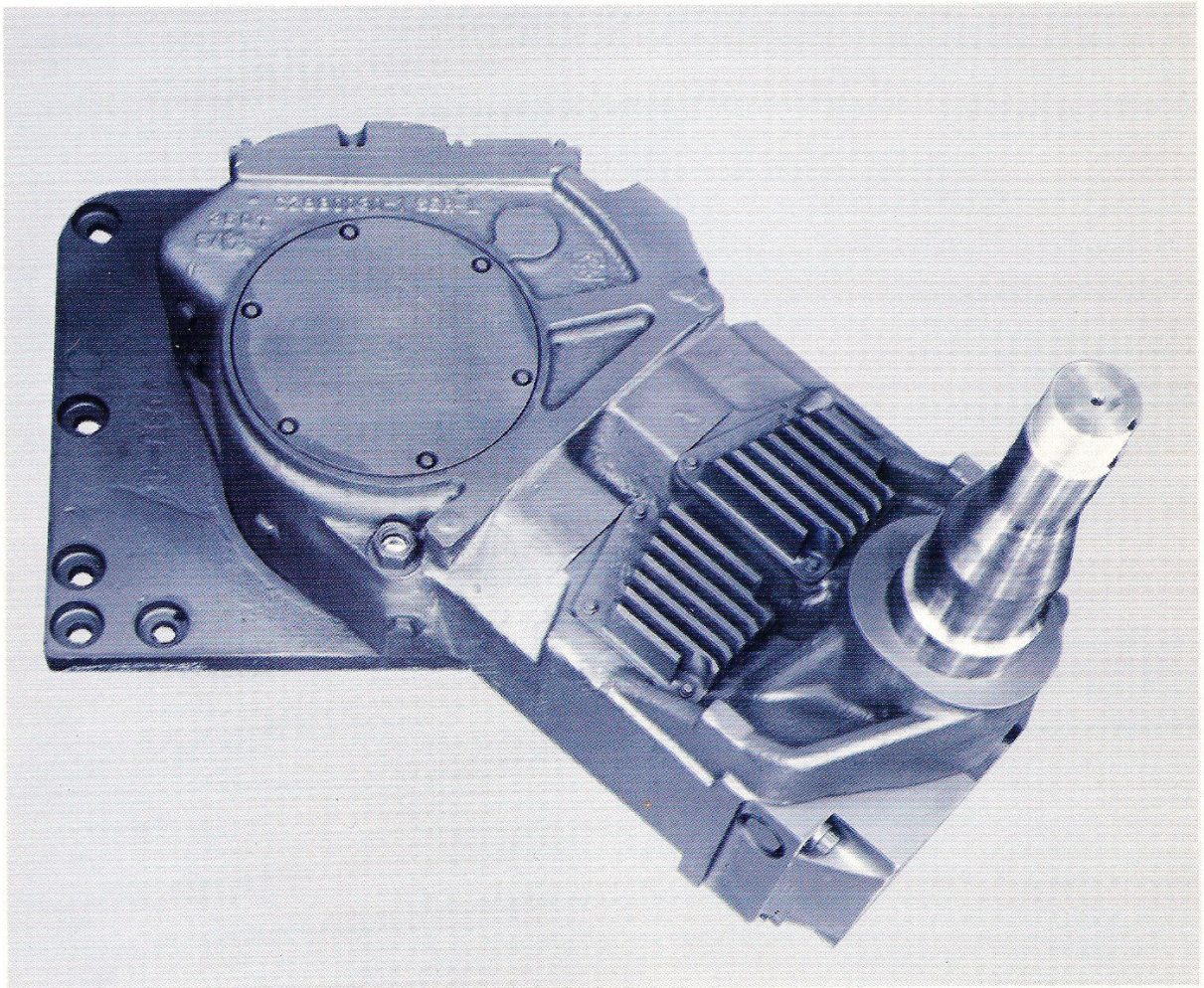


HYDROPNEUMATIC SUSPENSION SYSTEM

**FOR TRACKED / WHEELED
MILITARY VEHICLES**



MODEL 2880 IN-ARM HYDROPNEUMATIC SUSPENSION UNIT

 **TELEDYNE CONTINENTAL MOTORS**
General Products Division

The System

The Teledyne Hydropneumatic Suspension System (HSS) is a self-contained unit which provides both springing and damping for tracked and wheeled military vehicles. The HSS employs nitrogen gas as the spring medium. An accumulator free piston separates the nitrogen from the hydraulic circuit. Terrain forces are transmitted to an actuator piston which, in turn, acts on the accumulator free piston through a hydraulic circuit. The hydraulic circuit incorporates independent damping valves required for jounce and rebound control.

Production Experience

Teledyne has produced over 4,000 Hydropneumatic Suspension Units since 1980. The 900,000 square foot manufacturing facility located in Muskegon, Michigan is equipped with:

- The latest numerical control machining centers
- A separate clean room for the assembly of HSS
- Complete Chemical, metallurgical, and metrology labs
- Development testing facilities
- Extensive vehicle test facilities efficiently arranged on 67 acres
- Highly trained skilled work force
- Sophisticated computerized material control system complements the manufacturing processes and provides for on-time ordering receipt, and scheduling of manufacturing processed.

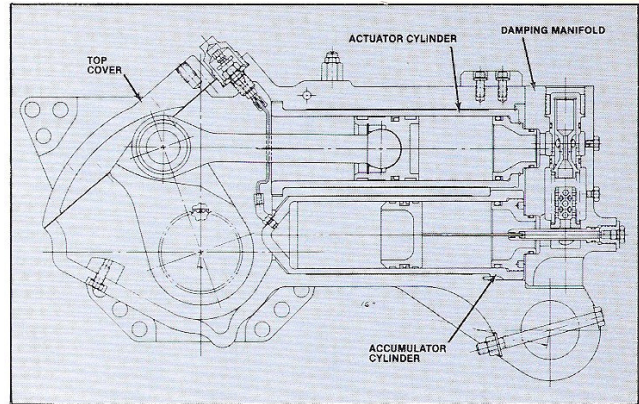
Factual RAM-D

Reliability is based on proven design techniques and actual vehicle test results. Teledyne's fielded production HSS's have accumulated 197,450 test miles with a unit MMBF of 338,485 miles. There have been no durability failures.

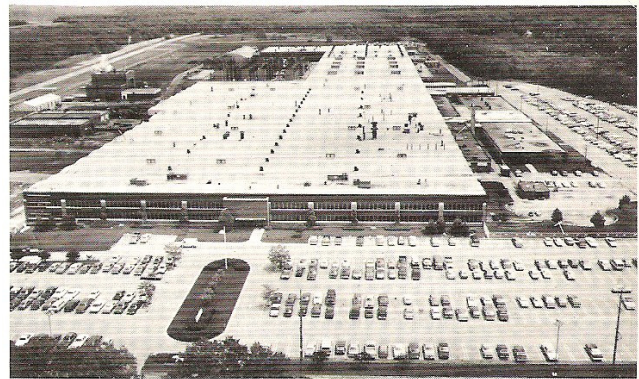
The HSS has been designed for fast, easy service. Fluid levels are checked every six (6) months by inserting a small charge indicator tool into the check-port of each unit's accumulator. No pressure gages or exotic testing equipment are necessary to service the units.

Cost Effective

- **Competitive initial cost.**
- **Reduces hull machining.**
Machining for torsion bar and damper installation can be eliminated.



Cross-sectional view of a typical Hydropneumatic Suspension Unit (HSU).



Aerial view of Teledyne's Muskegon, Michigan manufacturing facility.

- **Increases life of electronic system.**
As military vehicles become more complex and utilize more sophisticated electronic systems, a smoother ride enhances electronic componentry life.
- **Reduces suspension installation time.**
Self-contained bolt-on HSS eliminates need to install torsion bars and dampers during vehicle assembly.
- **Increases track and roadwheel life.**
The improved contact with the ground significantly reduces track throwing with demonstrated increase in roadwheel and track life.
- **Uses less ammunition, percent hits increase.**
The smooth ride of the HSS with damping to minimize vehicle pitch, bounce and roll motions increases hit probability. Gunnery results from M60 testing showed that the HSS improves gunnery results (percent hits) by 135% over standard torsion bars and by 80% over advanced torsion bars on the U.S. Army's Aberdeen Proving Ground (APG) bump course, 5/10/15/20 MPH average.

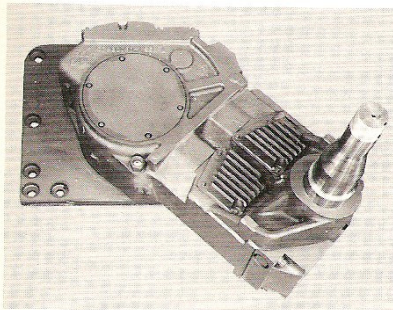
HSS Models

Teledyne is the world's leading producer and designer of a complete line of HSS. Three different types of HSS's

have been developed with various models offering application flexibility:

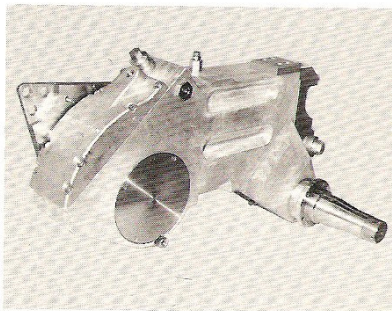
In-Arm Models

MODEL 2880



- 10,000 pound nominal load per wheel station.
- Designed for modern Main Battle Tanks.

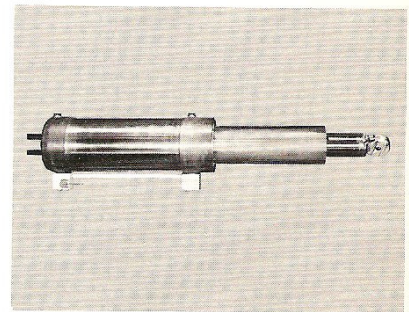
MODEL 2884



- 4,000 pound nominal load per wheel station.
- Designed for modern fighting vehicles and Armored Personnel Carriers (APC).

Linear Model

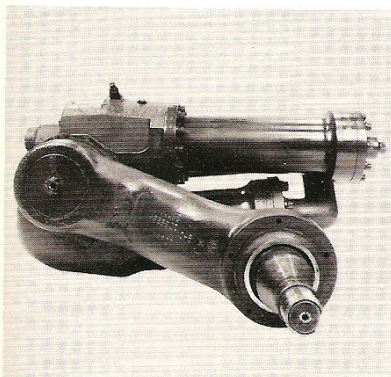
MODEL 1860



- 10,000 pound nominal load per wheel.
- Features wheel lift capability.
- Used for the U.S. Army Mobile Assault Bridge Ferry (MAB).

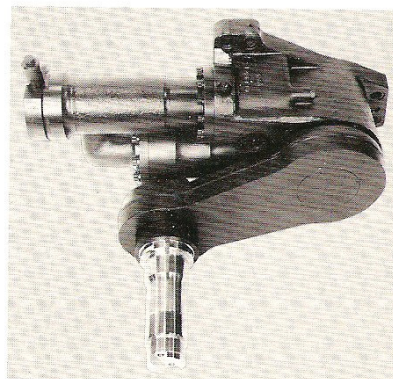
Road-Arm Models

MODEL 2866



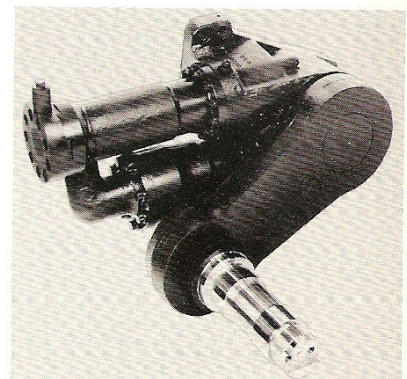
- 10,000 pound nominal load per wheel station.
- Designed for the M60 and M48 Main Battle Tanks and other vehicles.

MODEL 2867



- 10,000 pound nominal load per wheel station.
- Used for the High Mobility Agility Vehicle (HIMAG).
- Features the variable height control option.

MODEL 2869



- 10,000 pound nominal load per wheel station.
- Used for modernization of Centurion Main Battle Tanks.

Model 2880 In-Arm HSS

Model 2880 HSS was recently developed for modern military vehicles. For applications on Main Battle Tanks with seven (7) roadwheels per side, the nominal vehicle weight range would be 65 tons.

RATING

10,000 pounds capacity, nominal per unit when vehicle is in static position. 10 G's vertical load at the wheel with bump stop and 6 G's without bump stop.

MOUNTING

External to vehicle hull.

WEIGHT

450 pounds (fully operational with spindles and mounting pads).

WHEEL TRAVEL

20 inches: 16 inches jounce and 4 inches rebound.

DIMENSIONS

- Total width: 6.95 inches
- Rotating road-arm width: 5.93 inches
- Road-arm spindle swing radius: 18 inches
- Overall unit length: 29.32 inches

SERVICE INTERVAL

6 Months

PRESSURES

- 25,000 psi burst pressure
- 15,000 psi proof pressure
- 12,500 psi maximum operating pressure

Model 2884 In-Arm HSS

Model 2884 HSS was recently developed for modern military vehicles. For applications on tracked vehicles with six (6) roadwheels per side, the nominal vehicle weight range would be 24 tons.

The vehicle weight range can be increased if the wheel jounce travel is limited to less than 15 inches.

RATING

4,000 pounds capacity, nominal per unit when vehicle is in static position. 10 G's vertical load at the wheel with bump stop and 6 G's without bump stop.

MOUNTING

External to vehicle hull.

WEIGHT

160 pounds (W/O spindle)

WHEEL TRAVEL

19 inches: 15 inches jounce and 4 inches rebound.

DIMENSIONS

- Total width: 5.12 inches
- Rotating road-arm width: 4.25 inches
- Overall unit length: 27.03 inches
- Road-arm spindle swing radius: 16 inches

SERVICE INTERVAL

6 months

PRESSURES

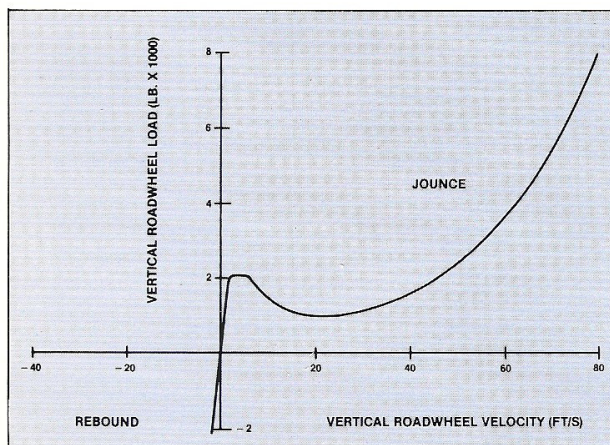
- 25,000 psi burst pressure
- 15,000 psi proof pressure
- 12,000 psi maximum operating pressure

HSS Advantages

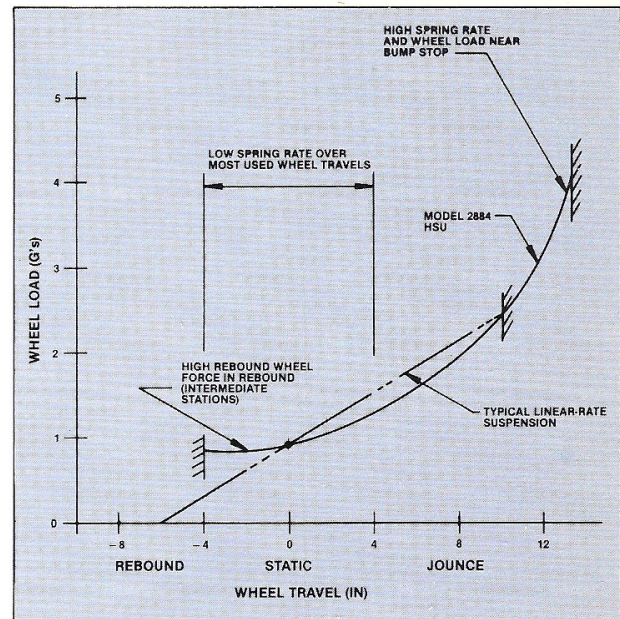
The Teledyne Hydropneumatic Suspension System (HSS) is both technically superior and cost effective as compared to conventional suspension systems.

TECHNICALLY SUPERIOR

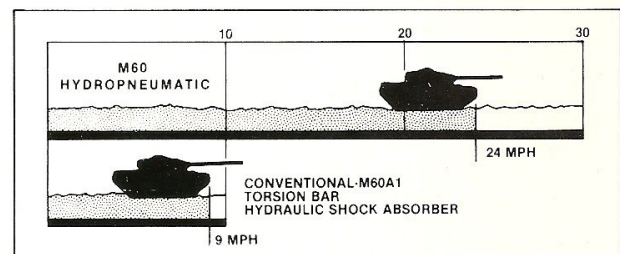
- Reduces vehicle silhouette for improved survivability.**
 The HSS is mounted externally to Main Battle Tank's hull, thus allowing engines and other major components to be mounted lower. Also, the optional variable height control offers considerable silhouette reduction.
- Increases internal hull space.**
 Externally mounted HSS does not interfere with valuable internal hull volume.
- Reduces weight.**
 Studies have shown that the HSS weighs less than comparable spring damping suspension systems.
- Improves crew comfort and combat effectiveness.**
 A unique feature of the HSS is a non-linear spring rate combined with high wheel travel which minimizes high accelerations being transmitted from the road to the hull and crew.
- Increases Cross-Country Mobility.**
 Average speed on Profile IV cross-country terrain is more than doubled for vehicles equipped with HSS.
- Improves Track Retention.**
 The HSS significantly improved the contact between roadwheel/track/ground when in operation on rough terrain. The U.S. Army's High Mobility Agility Vehicle (HIMAG) accumulated 7,000 miles without track loss.



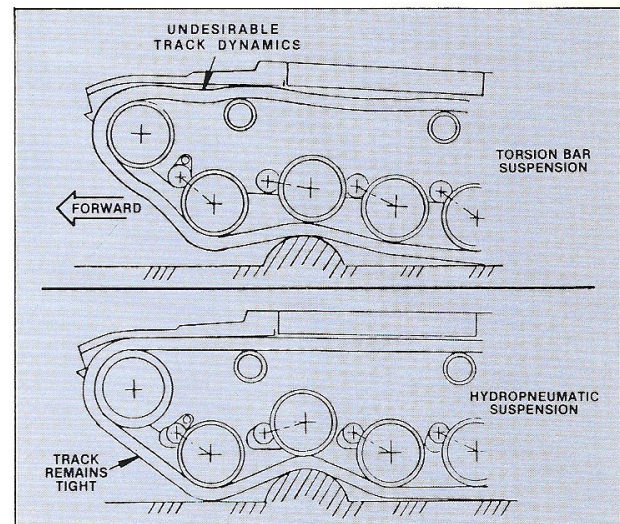
Damping levels are optimized to prevent vehicle pitch, bounce and roll motions.



Non-linear spring characteristics

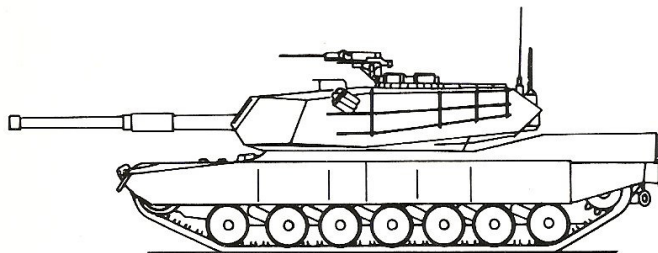


Average Speed Comparison on Profile IV Cross-Country Terrain.

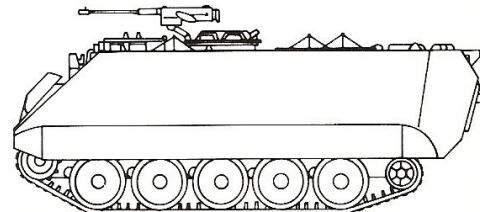


The HSS allows the wheels to return to the ground faster and maintain track tension and good track dynamics.

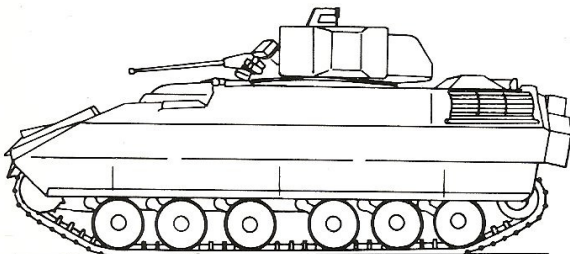
Applications



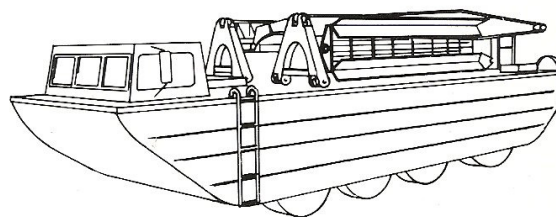
MAIN BATTLE TANKS



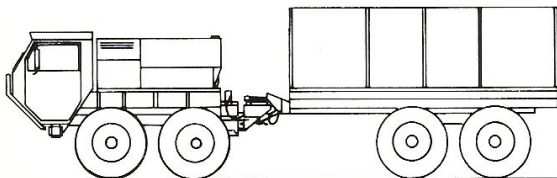
PERSONNEL CARRIERS



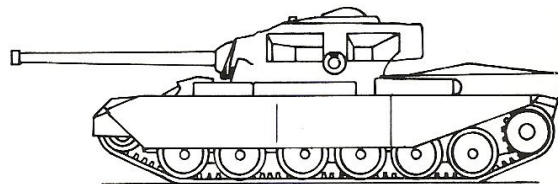
FIGHTING VEHICLES



MOBILE ASSAULT BRIDGE



WHEELED VEHICLES



**RETROFITS TO REPLACE EXISTING
SUSPENSION SYSTEMS**

